

**COMPOSITE ABRASIVE BODIES****Technical Field**

The invention relates to fabrication of composite abrasive bodies.

**Prior Art**

Abrasive products have been used for a long time for machining materials. Abrasive products consist of, *inter alia*, abradant granular particles which are fixed to a backing material by means of a binder.

DE 198 53 550 C1 describes an abrasive flap disc in which abrasive grains are dispersed on a base bonding coat that is applied to a backing.

US 5,722,881 describes use of epoxies for bonding abrasive flaps to an abrasive wheel.

A disadvantage of epoxies is the fact that either they have very long curing times or else they must be cured by heat. As a result, long holding times and/or high energy costs for curing are required for efficient mass production, which means increased costs for the production process.

**Description of the invention**

Therefore the aim of the present invention is to provide composite abrasive bodies which can be produced in such a way that the disadvantages of the prior art are avoided.

It was surprisingly found that this can be accomplished by means of a composite abrasive body as specified by Claim 1, as well as a method for its fabrication as specified by Claim 18.

This is achieved in particular by use of a two-component polyurethane or (meth)acrylate adhesive as specified by Claim 15 or Claim 16. Two-component polyurethane or (meth)acrylate adhesives cure extremely rapidly and in particular enable rapid bonding even at room temperature. This enables fast working times and energy-saving industrial mass production of these composite abrasive bodies.

### **Brief description of the drawings**

Exemplary embodiments of the invention are explained in more detail below with the help of the drawings. The same reference numbers are assigned to the same elements in the different figures. Force directions are indicated by arrows.

The drawings show:

- Fig. 1     partial cross section through the abrasive product support/abrasive product/adhesive assembly,  
             in Fig. 1a), abrasive product bonded to abrasive product support along the longitudinal surface,  
             in Fig. 1b), abrasive product bonded to abrasive product support along its transverse edge,  
             in Fig. 1c), a possible design for an abrasive product;
- Fig. 2     view of an abrasive flap disc;
- Fig. 3     partial cross section through an abrasive flap disc along the line AA;
- Fig. 4     view of a grinding machine with abrasive flap disc;
- Fig. 5     view of an abrasive flap wheel;
- Fig. 6     partial cross section through an abrasive flap wheel along the line BB;
- Fig. 7     view of a grinding machine with abrasive flap wheel;

Fig. 8 partial cross section through composite abrasive body to illustrate its fabrication,  
in Fig. 8a), inserted abrasive products  
in Fig. 8b), after the abrasive products have been tilted

Only the elements essential for direct understanding of the invention are shown.

### **Embodiment of the invention**

The present invention relates to a composite abrasive body including at least one abrasive product support, at least one abrasive product, as well as at least one cured two-component polyurethane or (meth)acrylate adhesive bonding the abrasive product support and the abrasive product to each other. Abrasive particles are also present on the surface of the abrasive product.

Throughout this document, by "(meth)acrylate" we mean both acrylic acid ester and methacrylic acid ester.

The present invention also includes use of a two-component (meth)acrylate adhesive, wherein the first component contains at least one (meth)acrylate monomer and the second component contains at least one radical initiator, in fabrication of a composite abrasive body, for bonding the abrasive product support and the abrasive product.

The present invention also includes use of a two-component polyurethane adhesive, wherein the first component contains at least one polyamine or one polyol and the second component contains at least one polyisocyanate, in fabrication of a composite abrasive body, for bonding the abrasive product support and the abrasive product.

Finally, the present invention includes a method for fabrication of a composite abrasive body that includes the following operations:

mixing of the two components of a two-component polyurethane or (meth)acrylate adhesive, application of the mixed adhesive to the abrasive product support, bringing the mixed adhesive into contact with at least one abrasive product, and curing the adhesive.

Figure 1 schematically shows a composite abrasive body comprising an abrasive product support 1 which is bonded to an abrasive product 2 by means of a two-component (meth)acrylate or polyurethane adhesive. The abrasive product here can be bonded along the large-area surface (Fig. 1a) or at or around its transverse edge (Fig. 1b).

Abrasive particles 3 are present on the surface of abrasive product 2. Abrasive particles 3 are made from materials such as are known to the person skilled in the art in this field. For example, here the abrasive can be natural or synthetic materials such as emery, garnet, flint, quartz, corundum, potassium fluoroborate, cryolite, chiolite, diamond, silicon carbide, cubic boron nitride (CBN), or the like. It is additionally known that these particles can be present in different grain sizes and grain shapes. The person skilled in the art selects the suitable material or materials in the respectively suitable grain size or mix of grain sizes in the respectively optimal grain shape, depending on the specific grinding problem. The abrasive product can have these particles over the entire surface or only in certain areas. However, preferably the abrasive particles 3 are present only on one side of abrasive product 2.

A flap-shaped abrasive member is especially preferred as abrasive product 2.

The abrasive product, or the flap-shaped abrasive member, can in turn be designed in very different ways. On the one hand, it can consist of a rigid material and abrasive particles 3, for example, as can be fabricated by a casting or sintering process from metal or duromers or reactive resins, optionally by dispersing the abrasive particles on the material or by rolling the abrasive particles into it. On the other hand, they can be constructed from at least one cloth or paper 101, at least one binder 102, as well as abrasive particles 3,

as shown schematically in Figure 1c. Crossply or knit fabric can also be used as the cloth. Fibers used for this purpose include carbon, glass, nylon, aramid, cotton, or polyester fibers as well as mixtures thereof. Various polymeric synthetic resins are used as binder 102 for embedding the abrasive particles, in particular reaction products based on polyepoxides, poly(meth)acrylates, or polyurethanes. For example, binders based on phenol—formaldehyde resins or polyimides are very suitable. Also suitable as binders for this purpose are the two-component (meth)acrylate or polyurethane adhesives 4 or the unfilled reactive components on which they are based.

Of course, in the case of a cloth, crossply, or knit fabric 101, the binder 102 can penetrate between the fibers and consequently the cloth, crossply, or knit fabric can be surrounded completely by binder, and not only on one side as shown in Figure 1c. It is also clear that the abrasive particles can be surrounded by cloth, crossply, or knit fabric 101 or their fibers, and not only by binder 102.

It is especially preferred for the abrasive particles to be embedded in the binder, i.e., for particles 3 to be partially surrounded by binder 102, where part of the surface of the particles is free.

In addition to the binder, optionally a size coat can also be used which is applied over binder 102 and, for example, protects the binder from outside influences.

Abrasive product support 1 plays the role of a carrier for abrasive product 2. Usually the abrasive product support is connected to a machine, connected in particular by means of clamping forces, so that the abrasive product comes into contact with the material to be abraded by means of rotary or shearing motions, and thus the material removal operation is accomplished.

The abrasive product support is made either from a rigid material such as metal or durometer plastics or from an elastic material. Elastic materials have the advantage

that they can be easily adjusted to fit the contours of the workpieces to be abraded, and thus in particular they are suitable for fine grinding operations or for workpieces with complex surface geometries. A disadvantage of elastic abrasive product supports is the lower mechanical load bearing capacity as well as the reduced lifetime of the abrasive product support.

Rigid materials as abrasive product supports do indeed have higher mechanical load bearing capacity, but they are difficult to use for grinding operations on workpieces which have mostly non-planar surfaces.

Abrasive product support 1 is preferably a circular disc, a wheel, or a belt. For this purpose, abrasive product 2 is preferably bonded to abrasive product support 1 on the largest area surface of the disc or wheel or belt, in particular in the radial direction of the disc or wheel.

Another advantageous option is for abrasive product 2 to be bonded to abrasive product support 1 on the peripheral surface of the wheel or circular disc, in particular in a radial orientation.

The adhesive used to bond abrasive product support 1 and abrasive product 2 is a two-component polyurethane or (meth)acrylate adhesive. Adhesive 4 reacts very fast even at room temperature. However, the possibility that the adhesive can also be cured at higher temperatures is not ruled out. The adhesive is cured in particular at a temperature between 10°C and 180°C, in particular between 20°C and 80°C, preferably between 20°C and 40°C, most preferably at room temperature. However, in particular for the two-component (meth)acrylate adhesive, it is advisable for safety reasons to use higher temperatures during application and curing.

If the adhesive is a two-component (meth)acrylate adhesive 4, the first component includes at least one (meth)acrylate monomer. Monofunctional, difunctional, trifunctional, tetrafunctional, and pentafunctional (meth)acrylate monomers are suitable. Particularly suitable (meth)acrylate monomers include methyl methacrylate,

isobornyl (meth)acrylate, cyclohexyl (meth)acrylate, *t*-butyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, dicyclopentadienyl (meth)acrylate, dicyclopentadienyloxyethyl (meth)acrylate, ethylene glycol di(meth)acrylate, di-, tri-, tetraethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, di-, tri-, tetrapropylene glycol di(meth)acrylate, butanediol di(meth)acrylate, hexanediol di(meth)acrylate, epoxy (meth)acrylate (in particular as can be synthesized from (meth)acrylic acid and bisphenol-A diglycidyl ether, bisphenol-A diglycidyl ether oligomers, bisphenol-A or ethoxylated bisphenol-A), trimethylol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol penta(meth)acrylate, as well as mixtures of these monomers.

The (meth)acrylate monomers preferably have a glass transition temperature above 55°C.

Under certain circumstances, it can be advantageous to select methyl methacrylate as the (meth)acrylate monomer. For example, this can be the case if the intense odor of this monomer is not a problem. However, odorless monomers or monomers with only a slight odor are preferred.

The first component of the two-component (meth)acrylate adhesive preferably includes at least one monomer selected from the group including isobornyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, diethylene glycol di(meth)acrylate, epoxy (meth)acrylate (in particular as can be synthesized from (meth)acrylic acid and bisphenol-A diglycidyl ether, bisphenol-A diglycidyl ether oligomers, bisphenol-A or ethoxylated bisphenol-A), trimethylol tri(meth)acrylate, as well as mixtures thereof.

Methacrylates are particularly preferred.

The second component of the two-component (meth)acrylate adhesive includes at least one radical initiator. All radical initiators known to the person skilled in the art in the field of (meth)acrylate adhesives are [suitable] as the radical initiator. Both thermal and photochemical radical initiators can be used. Peroxides are preferred as the radical initiator, in particular organic peroxides, preferably benzoyl peroxide.

Two-component (meth)acrylate adhesives of the SikaFast® series (commercially available from Sika Schweiz AG [Sika Switzerland], Zürich) or as are known from WO 02/070620 have been as particularly suitable.

Just for the sake of completeness, here we mention that it is also possible in principle to use a photochemically cured one-component (meth)acrylate adhesive instead of a two-component (meth)acrylate adhesive. Photochemical curing is achieved by exposure to a light source, in particular a high-pressure mercury lamp or a laser. A disadvantage of this solution, however, is the need for such a light source and possibly the problem that for certain embodiments according to the present invention, the adhesive area may be shaded.

If the adhesive is a two-component polyurethane adhesive, the first component of the adhesive includes at least one polyol or one polyamine and the second component includes at least one polyisocyanate.

A polyamine is a molecule with two or more amine functional groups, in particular primary amine groups. Examples of such polyamines are aliphatic polyamines such as ethylenediamine, 1,2- and 1,3-propanediamine, 2-methyl-1,2-propanediamine, 2,2-dimethyl-1,3-propanediamine, 1,3- and 1,4-butanediamine, 1,3- and 1,5-pentanediamine, 1,6-hexanediamine, 2,2,4- and 2,4,4-trimethylhexamethylenediamine and mixtures thereof, 1,7-heptanediamine, 1,8-octanediamine, 4-Aminomethyl-1,8-octanediamine, 1,9-nonanediamine, 1,10-decanediamine, 1,11-undecanediamine, 1,12-dodecanediamine, methyl bis(3-aminopropyl)amine, 1,5-diamino-2-methylpentane (MPMD), 1,3-diaminopentane (DAMP), 2,5-dimethyl-1,6-hexamethylenediamine, cycloaliphatic polyamines such as 1,3- and 1,4-diaminocyclohexane, bis(4-aminocyclohexyl)methane, bis-(4-amino-3-methylcyclohexyl)methane, bis(4-amino-3-ethylcyclohexyl)methane, bis(4-amino-3,5-dimethylcyclohexyl)methane, 1-amino-3-aminomethyl-3,5,5-trimethylcyclohexane (= isophoronediamine or IPDA), 2- and 4-methyl-1,3-diaminocyclohexane and mixtures thereof, 1,3- and 1,4-bis(aminomethyl)cyclohexane, 1-cyclohexylamino-3-aminopropane, 2,5(2,6)-bis(aminomethyl)bicyclo[2.2.1]heptane (NBDA, manufactured by Mitsui Chemicals),



3(4),8(9)-bis(aminomethyl)tricyclo[5.2.1.0<sup>2,6</sup>]decane, 3,9-bis(3-aminopropyl)-2,4,8,10-tetraoxaspiro[5.5]undecane, 1,3- and 1,4-xylylenediamine, ether group-containing aliphatic polyamines such as bis(2-aminoethyl) ether, 4,7-dioxadecane-1,10-diamine, 4,9-dioxadodecane-1,12-diamine and higher oligomers thereof, polyoxyalkylene polyamines with theoretically two or three amino groups, for example as can be obtained under the name Jeffamine<sup>®</sup> (manufactured by Huntsman Chemicals), aromatic amines such as, for example, 3,5-diethyl-2,4(2,6)-diaminotoluene (Lonzacure DETDA<sup>®</sup>), 3,5-dimethylthiotoluylenediamine (Ethacure 300<sup>®</sup>), 4,4'-methylene-bis(2,6-diethylaniline) (MDEA), 4,4'-methylene-bis(3-chloro-2,6-diethylaniline) (MCDEA), as well as mixtures of the aforementioned polyamines.

A polyol is a molecule with two or more hydroxy functional groups. For example, the following commercially available polyols or any mixtures thereof can be used:

-Polyoxyalkylene polyols, also called polyether polyols, which are the polymerization product of ethylene oxide, 1,2-propylene oxide, 1,2- or 2,3-butylene oxide, tetrahydrofuran or mixtures thereof, optionally polymerized using an initiator molecule with two or three active H atoms such as, for example, water or compounds with two or three OH groups and/or NH<sub>2</sub> groups. Polyoxyalkylene polyols can be used that have a low degree of unsaturation (measured according to ASTM D-2849-69 and expressed in milliequivalents of unsaturation per gram polyol (meq/g)), synthesized for example using "double metal cyanide complex catalysts" (DMC catalysts for short), as well as polyoxyalkylene polyols with a higher degree of unsaturation, synthesized for example using anionic catalysts such as NaOH, KOH, or alkali metal alkoxides. Polyoxyalkylene diols and triols are especially suitable which have a degree of unsaturation below 0.02 meq/g and a molecular weight in the range from 1000 to 30 000 g/mol, polyoxypropylene diols and triols with a molecular weight from 400 to 8000 g/mol, as well as "EO-endcapped" (ethylene oxide-endcapped) polyoxypropylene diols or triols. The latter are special polyoxypropylene polyoxyethylene polyols,

that can be obtained, for example, by alkoxyating pure polyoxypropylene polyols with ethylene oxide, after completion of polypropoxylation, and thus have primary hydroxyl groups. Here and in the following, by "molecular weight" we always mean the average molecular weight  $M_w$ .

- Polyhydroxy-terminated polybutadiene polyols;

- Polyester polyols, synthesized for example from dihydric or trihydric alcohols such as, for example, 1,2-ethanediol, diethylene glycol, 1,2-propanediol, dipropylene glycol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, neopentyl glycol, glycerol, 1,1,1-trimethylolpropane or mixtures of the aforementioned alcohols, with organic dicarboxylic acids or their anhydrides or esters such as, for example, succinic acid, glutaric acid, adipic acid, suberic acid, sebacic acid, dodecanedicarboxylic acid, maleic acid, fumaric acid, phthalic acid, isophthalic acid, terephthalic acid, and hexahydrophthalic acid or mixtures of the aforementioned acids, as well as polyester polyols derived from lactones such as, for example,  $\epsilon$ -caprolactone;

- Polyether polyols or polyester polyols synthesized from tetrahydric or polyhydric alcohols such as pentaerythritol, sorbitol, mannitol, and other sugar-based alcohols.

- Polycarbonate polyols, as can be obtained, for example, by reaction of the above-indicated alcohols (used to synthesize the polyester polyols) with dialkyl carbonates, diaryl carbonates, or phosgene.

The indicated polyols have an average molecular weight from 250 to 30 000 g/mol and an average number of OH functional groups in the range from 1.6 to 3.

In addition to the indicated polyols, the following can be used: low molecular weight compounds with two or more hydroxyl groups such as, for example, 1,2-ethanediol, 1,2- and 1,3-propanediol, neopentyl glycol, diethylene glycol, triethylene glycol, the isomeric dipropylene glycols and tripropylene glycols, the isomeric butanediols, pentanediols, hexanediols, heptanediols, octanediols, nonanediols, decanediols, and undecanediols, 1,3- and 1,4-cyclohexanedimethanol, hydrogenated bisphenol A, 1,1,1-trimethylolethane, 1,1,1-trimethylolpropane,

glycerol and sugar alcohols and other alcohols with a high number of OH groups.

A polyisocyanate is a molecule with two or more isocyanate groups. This in particular means a polyurethane prepolymer which can be synthesized from polyisocyanates, in particular selected from the group including 1,6-hexamethylene diisocyanate (HDI), 2,4- and 2,6-toluylene diisocyanate (TDI), 4,4'-diphenylmethane diisocyanate (MDI), 1-isocyanato-3,3,5-trimethyl-5-isocyanatomethylcyclohexane (= isophorone diisocyanate or IPDI), their isomers, their polymers, as well as their mixtures, and polyols, in particular the polyols already mentioned above, in particular polyoxyalkylene polyols.

Two-component polyurethane adhesives of the SikaForce® series (commercially available from Sika Schweiz AG [Sika Switzerland], Zürich) have been especially suitable for this purpose.

The early strength (at least until achievement of early strength high enough to permit transport of the composite abrasive body) of a two-component polyurethane or (meth)acrylate adhesive at room temperature is preferably achieved within less than 30 minutes, in particular within less than 10 minutes, as measured from the time the two components are mixed. In special cases, an early strength achieved within less than 5 minutes may even be desired.

Two-component polyurethane or (meth)acrylate adhesives additionally provide potlives at room temperature of preferably less than 20 minutes, in particular less than 10 minutes. In special cases, a potlife of less than 5 minutes is advantageous.

Two-component (meth)acrylate adhesives are the preferred adhesives, since this type of adhesive provides extremely favorable curing behavior. As a result of the radical polymerization mechanism, the viscosity of the adhesive abruptly increases considerably only at the very end of the open time,

so the adhesive can be easily worked to practically the same extent throughout the time between mixing and this rise in viscosity at the end of the open time. This is not the case for addition polymerization, as occurs for two-component polyurethane adhesives. In that case, the viscosity rises steadily after mixing, so the handling properties change considerably even before the end of the potlife. (Meth)acrylate adhesives are likewise advantageous, because they reach final strength faster.

It has proven to be especially advantageous if the two-component (meth)acrylate or polyurethane adhesive displays thixotropic behavior. Such thixotropic properties can be induced chemically or physically. It can also be advantageous for the adhesive to have a pasty consistency. Thixotropy or a pasty consistency is especially advantageous because the effect is that an abrasive product inserted into the adhesive is held in this position at least long enough for the adhesive to become sufficiently crosslinked so it has enough strength to hold the abrasive product in position. Thixotropy is especially preferred, since the thixotropic behavior allows the abrasive product to be easily inserted into the adhesive but then it is held in position, without its own weight making it tip over in an uncontrolled manner.

A two-component (meth)acrylate or polyurethane adhesive can also, as needed in each case, contain other components such as fillers, drying agents, catalysts, thixotropic agents, additives such as adhesion promoters, light stabilizers, defoamers, flow-control agents, and impact strength modifiers. Persons skilled in the art will use their expertise in using such additives, and will use them respectively in one or both components.

Figure 2 depicts an abrasive flap disc 9, which represents a preferred embodiment of a composite abrasive body. Here the abrasive products 2 are flap-shaped abrasive members that are disposed on abrasive product support 1, partially overlapping each other in a fan-like manner, and are bonded to abrasive product support 1 by means of a two-component (meth)acrylate or polyurethane adhesive.

This structure also can be described as a shingle-like arrangement of abrasive flaps. Abrasive product support 1 here has the shape of a circular disc. The disc preferably has a hole 5 in the center, through which a mandrel 7 can be inserted. Abrasive product support 1 also preferably has a reinforcing ring 6.

Figure 3 depicts a partial cross section along line AA through the peripheral area of abrasive flap disc 9 and shows abrasive products 2, partially overlapping in a shingle-like fashion, with abrasive particles 3 on their surfaces. The abrasive products are joined to abrasive product support 1 with polyurethane or (meth)acrylate adhesive 4.

Finally, Figure 4 depicts a view of a grinding machine 8 with abrasive flap disc 9 connected by means of mandrel 7, which through hole 5. The abrasive flap disc has abrasive products 2 radially bonded to disc-shaped abrasive product support 1.

Figure 5 depicts an abrasive flap wheel 12, which represents another preferred embodiment of a composite abrasive body. Here the abrasive products 2 are flap-shaped abrasive members disposed on abrasive product support 1, partially overlapping each other, and are bonded to abrasive product support 1 by means of a two-component (meth)acrylate or polyurethane adhesive 4. Abrasive products 2 here are on the peripheral surface of the abrasive flap wheel. The abrasive flap wheel preferably has a hole at the centerline point and optionally a nut 10 with thread 11 on the inside of the nut. The abrasive flap wheel also preferably has a reinforcing ring 6.

Figure 6 depicts a partial cross section along line BB through the peripheral area of abrasive flap wheel 12 and shows abrasive products 2, partially overlapping in a shingle-like fashion, with abrasive particles 3

on their surfaces. The abrasive products are joined to abrasive product support 1 with a polyurethane or (meth)acrylate adhesive 4.

Finally, Figure 7 depicts a schematic view of a grinder 13 with an abrasive flap wheel 12.

Another preferred embodiment of a composite abrasive body is an arrangement in which abrasive product support 1 is a wheel and abrasive products 2, in particular flap-shaped and sticking out radially on the peripheral surface of the wheel in the vertical direction relative to the peripheral surface, are bonded with a two-component polyurethane or (meth)acrylate adhesive 4.

Another preferred embodiment of a composite abrasive body is an abrasive belt. Here abrasive product 2 is bonded flat against abrasive product support 1 product 2 using two-component polyurethane or (meth)acrylate adhesive 4. The abrasive belt can be a sheet or an endless belt.

The present invention also includes a method for fabrication of a composite abrasive body.

This method includes at least the steps described below. The two components of a two-component polyurethane or (meth)acrylate adhesive 4 are mixed with each other. This operation is carried out with conventional mixing devices, in particular by means of a static mixer. Then the mixed adhesive is applied to the abrasive product support, preferably in the form of an adhesive bead. This operation is done where the abrasive products are to be joined to the abrasive product support, in particular in the peripheral areas of a disc or a wheel. Then the mixed adhesive is brought into contact with at least one abrasive product before the potlife of the adhesive has elapsed.

This contact should preferably be made in such a way that the abrasive product, which is preferably a flap-shaped abrasive member, is inserted into the mixed uncured adhesive (applied to abrasive product support 1) essentially vertically with respect to the abrasive product support surface, so that part of the surface is covered by adhesive.

Such an arrangement is depicted schematically in Fig. 8a). Finally, the adhesive is cured.

One more step, involving tilting the abrasive products, preferably occurs between bringing the abrasive products into contact with the mixed adhesive and curing of the adhesive. In this way, the abrasive products, inserted next to each other in the uncured adhesive, are taken from an essentially vertical orientation to a tilted orientation in a controlled manner. Thus a fan-like or shingle-like partial overlapping of abrasive products 2 is achieved, as shown schematically in Figure 8. This is achieved in particular by means of a tangential force preferably exerted on the abrasive products on the side opposite the adhesive, as is shown schematically in Figure 8a).

The abrasive products are advantageously tilted only after all the abrasive products have been brought into contact with the adhesive.

In the case of fabrication of an abrasive flap disc 9, this tilting of the flap-shaped abrasive members is preferably achieved by means of a combination rotational and pushing motion of a body touching the free edge of the upright flap-shaped abrasive members.

It also can be advantageous for the surface of abrasive product support 1 and/or abrasive product 2 to undergo chemical or physical pretreatment before bonding. Such pretreatment involves, for example, grinding, brushing, sand blasting, treatment with cleaning agents, adhesion promoter solutions, or primers. This can, for example, result in better adhesion and thus lead to greater safety and/or load bearing capacity of the abrasive composite.

The steps of mixing, application, bringing into contact, and curing typically are carried out at a temperature between 10°C and 180°C, usually between 20°C and 80°C, in particular between 20°C and 40°C. This is preferably done at room temperature.

This described method is then especially to be employed if the adhesive 4 used exhibits thixotropic behavior and/or has a pasty consistency.

**List of reference numbers**

- 1 Abrasive product support
- 2 Abrasive products
- 3 Abrasive particles
- 4 Polyurethane or (meth)acrylate adhesive
- 101 Cloth or paper
- 102 Binder
- 5 Hole
- 6 Reinforcing ring
- 7 Mandrel
- 8 Grinding machine
- 9 Abrasive flap disc
- 10 Nut
- 11 Thread
- 12 Abrasive flap wheel
- 13 Grinder